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AUTHOR Mazurkiewicz, Albert J.; Kleederman, Frances
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ABSTRACT

A study of the constraints on word recognition errors (miscues) readers make when reading a passage printed conventionally and one printed in a regularized orthography such as the initial teaching alphabet (i.t.a.) was undertaken with 50 second-grade students divided equally between children taught according to the orthographies being studied. The passage was deliberately created to set up wrong predictions and to cause readers to consciously confirm these predictions before they continued reading. The students read the selection aloud, and miscues were recorded including pauses, insertions, omissions, substitutions, repetitions, self-corrections, and mispronunciations. The students were asked questions related to comprehension after they finished reading. It was found that the i.t.a. sample had significantly fewer miscues thought to be produced by content and syntax than the conventional alphabet sample. Comprehension was also significantly higher among i.t.a. students. (TJ)

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THE CONSTRAINTS OF ORTHOGRAPHY ON READING MISCUES*

Albert J. Mazurkiewicz

and

Frances Kleederman

Kean College of New Jersey

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Frances Kleederman

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Goodman's (1967:126) theory of reading as a psycholinguistic guessing game is described as follows:

> "Reading is a selective process. It involves partial (emphasis added) use of available minimal language cues selected from perceptual input on the basis of the reader's expectation. As the partial information is processed, tentative decisions are made to be confirmed, rejected or refined as reading progresses."

Goodman (1969: 9) indicates that "all responses to the graphic display are caused and are not accidental or capricious." Goodman (1969: 10) further points out that

> "three kinds of information are available to the reader. One kind, the graphic information, reaches the reader visually. The other two, syntactic and semantic information are supplied by the reader as he begins to process the visual input. Since the reader's goal is meaning, he uses as much or as little of each of these kinds of information as is necessary to get to the meaning."

While the reader reads, it can be assumed, he makes predictions of the grammatical structure based on the language structure he internalized as he developed oral language. He supplies semantic concepts to get some meaning from the structure. In turn, his sense of syntactic structure and meaning make it possible for him to predict the graphic input so he becomes highly selective, sampling the print to confirm his prediction. In short, what the reader thinks he sees is partly what he sees, but largely what he expects to see.

In a similar vein, Smith (1971:187) in describing his theoretical views

of the reading process, notes that "meaningful sequences of words can be indentified when there is insufficient featural information to identify any of the individual words in isolation", and argues that comprehension of meaning precedes word indentification rather than follows it. Goodman (1976:270) concurs when he indicates that "words do not really exist". While Smith notes that "it is a little difficult to demonstrate the major thesis that the identification of individual words is completely irrelevant to reading for meaning" he insists that proof for his theory that meaning precedes word identification in reading lies in the phenomenen of eye-voice span (1973: 59). He argues (1973: 61) that the able reader's occassional inability to notice a misspelled word in a passage is evidence that a sequence of words are identified only after the reader has gained the meaning of the sequence of words. Strickland (1974: 50) indicates her agreement with Goodman's and Smith's views when she points out that "comprehending frequently appears to take place before one utters the words aloud! For example in the passage (See illustration one, page 5) by Gary Gilarr (1974: 49) "She had tears in her dress and tears in her eyes, " Strickland (1974: 49) noted that "one has to understand what t-e-a-r-s means before one can pronounce it correctly." The implication is that the reader has to have read and understood the phrases in her dress and in her eyes before he knows which meaning the word tears has preceeding each phrase and thus pronounce it correctly.

The theoretical positions of Goodman and Smith and as illustrated by Strickland indicate that the fluent reader of traditionally printed English relies heavily on semantic and syntactic features of language to obtain correct meanings and that the graphic array plays a minor role in reading. These positions may be questioned in terms of whether they are universally applicable to all kinds of reading situations (Spanish, Italian, Russian, Chinese, Japanese, etc.). They may also be questioned in English. While the phenomonen of eye-voice span, the ability demonstrated in oral reading studies where the reader's eyes are found to track three to five words ahead

of his voice, undoubtedly indicates that the good oral reader attends to the syntactic and semantic cues of a passage printed in traditional orthography since the graphic array is not reliable, there is no evidence to indicate that he is not also identifying (correctly or not) the individual words in the sequence of the passage. It is possible that he may make errors in identification because of misleading grapho-phonemic sequences tho he is responding to the semantic and syntactic cues of the passage. Groff (1976:145) for example, notes that

> "there are linguists who suggest that the first process one goes through in analyzing a sentence is to determine the surface structure of the sentence, its words and the boundaries of the phrases. Only then is it held possible for the deep structure, the meaning of the sentence, to be determined."

It is obvious that this contradicts the view, he points out, "that meaning identification is made before word identification."

It seems possible, too, to determine the validity of these theoretical positions in English by empirical means. A study of the constraints on the word recognition errors (miscues) readers make when reading a passage printed conventionally and when printed in a regularized orthography is one possible approach. The difficulty with such a study is, of course, that of obtaining sufficient skill thru practice in reading the regularized orthography to insure comparability with the skill developed by practice reading traditional print. Another alternative in the study of the effect regularized print has on word recognition (miscues) as well as on comprehension is to select two random samples of pupils who are comparable in reading skill in traditional orthography on a given test but who have learned to read and are currently proficient in their respective media; (e.g., traditional print and a regularized orthography such as i.t.a.). Such a study, if the passage

pupils are to read is identical and designed to set up wrong predictions as illustrated by the "tears" sample quoted by Strickland, should not only show the dependency of pupils on semantic and syntactic information to develop meaning and in producing miscues on given target words (such as tears) but also show any constraints, that is, any elimination or reduction of miscues, a regularized orthography such as i.t.a. has on such words. It would appear that such a study is the most viable, if not the only, approach possible when comparability of reading skill must be the basic consideration. The null hypotheses for such a study would be that

1. no difference in the number of muscues on the target words in a passage would exist between two comparable samples.
2. no difference in the comprehension of the selection as reflected in questions related to the target words would exist between the two samples.

The implied hypothesis is that a change in orthography which produces a more regular grapheme-phoneme correspondence would not have any effect on the miscues and, in turn, the comprehension of readers, since semantic and syntactic language skills are of primary importance in obtaining meaning and in producing correct word identifications.

Definitions

Miscues, as identified by Goodman, is the phenomenon that occurs in oral reading when a reader deviates from the expected response (ER); i.e., when a reader produces something other than what is on the printed page. It is called a miscue because it is assumed that the reader has not made a careless, random error, but that his response has been "cued" by information available to him as a user of language. In earlier times such errors were (and still are)called word recognition errors, but, for purposes of this study, Goodman's terms are used to provide a direct analogy for study.

Test Material

The selection often cited by proponents of miscue theory (Strickland, 1974) was utilized to test the hypotheses established for the study. The passage constructed by Gary Gilarr (1974) was "deliberately created to set up wrong predictions, and to cause a reader to consciously confirm these predictions before he continues reading. "Frequently," Dr. Strickland (1974: 49) noted, "readers are forced to regress in order to correct themselves, or to consciously 'read ahead' before deciding how to read 'tears' or 'minute'." The selection, noted below in its traditional orthographic (T.O.) and i.t.a. (initial teaching alphabet) forms, was transliterated and printed by the authors using regular typewriter typefaces of equal pointage.

Illustration One

The boys' arrows were nearly gone so they sat down on the grass and stopped hunting. Over at the edge of the wood they say Henry making a bow to a small girl who was coming down the road. She had tears in her dress and tears in her eyes. She gave Henry a note which he brought over to the group of young hunters, Read to the boys, it caused great excitement. After a minute, but rapid examination of their weapons they ran down to the valley. Does were standing at the edge of the lake, making an excellent target.

the boi's arrœs wer nœrly gon sœ thee sat dun on the grass and stoppt huntig. œver at the edʒ ov the wod thre saw henry mœkig a bu to a smull girl who wos cumig dun the rod. Shee had teers in her dress and teers in her iez. Shee gav henry a net which hee braut œver to the grop ov yug hunters. red to the boiz, it cusd grœt eksietment: after a mienet, but rapid egzamindun ov theer wepons thre ran dun to the vally. dœz wer standig at the edʒ ov the lœk, mœkig an eksellent target.

Comprehension of the target selection as noted below was related to four of the five target words (bow, tears, minute, does) and included a question related to the second usage of the word tears. Following the pattern recommended in constructing reading inventories, two factual, two inferential and one vocabulary items were developed as the basis for testing comprehension. A sixth question "What did Henry do with the note the girl gave him?" was eliminated in favor of the additional question related to the second usage of tears.

Comprehension Questions

1. What did Henry do when he saw a small girl coming down the road? _____
2. Was the little girl's dress new? _____
3. Was the little girl happy? _____
4. What does "minute" mean? _____
5. Name the animals that were standing at the edge of the lake. _____

Based on the Fry readability formula, the passage, containing 125 syllables and 6.9 sentences in the first hundred words, had a readability of 6.0. While this readability may seem excessive when utilized for oral reading of first and second grade children in regular instruction, it is appropriate to the purposes of the study and follows the theoretical view of Goodman, (1973) that miscue errors can best be observed in material beyond the normal reading ability of the pupil.

Samples and Procedures

To meet the purpose of this study, two samples were developed utilizing two school systems each of which had similar socio-economic characteristics and in which the pupils had been continuously taught in either the i.t.a. or T.O. media for more than five years. The latter restriction was established

to eliminate any unfamiliarity or newness of program factor and to insure that sufficient experience with the achievements of the children was available so that the appropriate periods for testing could be established.

In the case of the T.O. sample, repetitive testing over a period extending from the eighth month of the first grade to the fourth month of the second with a prior population was done to determine the optimal time to establish a sample of children which would read well enough to achieve at least at a 3.0 grade equivalent on standardized test measures. The optimal time was established as the third month of the second school year, a period when at least 25 children out of 350 in the second grade would normally achieve the desired status. The establishment of a 3.0 or better grade equivalent was made to insure that children had developed decoding skills to the point where minumum cues in reading were beginning to be utilized and that decoding skill was internalized to a large extent.

Second grade teachers in the district were invited to nominate their best readers for use in this study and the children were tested using the Gates-MacGinitie reading test and the Peabody Picture Vocabulary IQ test. Those meeting the minumum criteria were randomly selected to complete the oral reading of two preliminary stories and the target story (Illustration One). The tests were administered by specially trained research assistants. The preliminary stories were used as the basis for acclimatizing the pupil to the procedures of the testing, to develop rapport with the child and to ensure that the child felt comforable in performing the task demanded. Miscues and comprehension errors were recorded for all three stories to ensure that the child understood that whatever he said would be recorded. Only the miscue errors on the target words in the test story were utilized for the analysis shown later.

The i.t.a. sample was similiarly chosen and tested. The time of testing differed, however, to ensure that the children were being instructed in the i.t.a. Based on prior experience, it was determined that only those children who were reading (and being instructed) in Book 5 of the Early to Read - i.t.a. series (Mazurkiewicz and Tanyzer, 1968) would be tested using the Gates-MacGinitie Reading Test to develop a sample of children achieving at 3.0 or better. Book 5 of this series is wholly in i.t.a. while Book Six begins to phase out i.t.a. The elimination of any possible dimunition in efficiency in reading in i.t.a. was thus estabished by restricting the sample to only those children who were still being instructed wholly in i.t.a. The testing on the Gates-MacGinitie in traditional print and on the Peabody Picture Vocabulary I.Q. Test was made in April of the first grade year. Those children achieving 3.0 or better on this test were then tested using the preliminary stories and the target story, the materials differing from those used with the T.O. sample only in that they were printed in the i.t.a. medium (Illustration One).

Thus two samples of 25 pupils, similarly competent in reading in T.O. as measured by the same standardized test in one medium (T.O.) were established. The results were tabulated and subjected to statistical analysis as noted below.

Discussion

An initial sample of 37 children from the T.O. population were located utilizing the Gates-MacGinitie Reading Test. Economic and absence (owing to health) factors precluded utilizing all children in the final samples. The number of children identified in each sample is of relatively little importance but the difference in the time of testing is of significant importance. Testing at the 8th month (i.t.a.) and 13th month (T.O.) becomes at the same time a covariable which is perfectly confounded with the medium of instruction used and a critical difference in terms of the relative educational values

of each orthography.

While I.Q., sex, and grade equivalent scores on the test of reading achievement were utilized as dependent variables in the analysis of covariance, the difference in the number of months each sample had spent in instruction could not be similarly utilized since the number of months 8 and 13 caused a computer abort during the analysis of covariance (Biomed). It was determined that these numbers were perfectly confounded with the medium (i.t.a. or T.O.) utilized to differentiate between the populations and could just as easily have been the defining characteristic for a study of the mean differences in miscue and comprehension results.

The difference in the number of months each sample needed for instruction (8 as opposed to 13) to achieve a 3.0 grade equivalent or better status on standardized tests provides a clear index to the relative merits of i.t.a. (a largely one-sound, one-symbol medium) versus Traditional Orthography (a complex of phoneme-grapheme relationships).

Prior research on the value of a regularized orthography is supported by this unexpected finding. This 5 month difference between the samples becomes of educational interest in demonstrating the effectiveness and efficiency of the i.t.a. in producing reading skill.

Testing Procedures

As each child read aloud the selections, all of his miscues or errors in fluency and recognition were recorded. These included insertions, pauses, omissions, substitutions, repetitions, self-corrections and mispronunciation. On completion of each story, questions to tap his comprehension of the selection were asked and his/her responses were recorded.

Children were removed from regular classrooms to the testing site in

each building to prevent others who would be tested later from overhearing the oral readings and question responses.

Characteristics of the Samples

Although analysis of covariance was utilized to determine the significance orthographic change had on miscues and comprehension, it can be seen in the data

Table I

Intelligence, Reading Achievement & Sex Balances of the Samples

Treatment	I.Q.	Reading	Boys	Girls
	M	M	Total	Total
i.t.a.	121.64	3.48	13	12
T.O.	122.00	3.55	12	13

shown in Table I that random selction procedures produced a close match between the samples. The differences in I.Q. and Reading, favoring the T.O. population, are non-significant and these slight differences were corrected for in the analysis of covariance procedures.

Results

As noted in Table II, the analysis of covariance on the miscue data used

Table II

Analysis of Covariance on the Miscue Data

Source	DF	YY	Sum-Squares (Due)	Sum-Squares (About)	DF	Mean-Square
Treatment (Between)	1	118.5798				
Error (Within)	48	29.4402	2.0257	27.4145	45	.6092
Treatment & Error (Total)	49	148.0200	15.8164	132.2036	46	
Difference for testing adjusted treatment means				104.7890	1	104.7890

to test the null hypothesis that there would be no difference among treatments after adjusting with covariates indicates that the hypothesis is rejected with extremely high confidence since the F (1, 45) equals 172.008. The results indicate that the orthographic change utilizing i.t.a. has a tremendously significant effect on the reduction of miscues typically thought of as being produced by content and syntax. The data suggest that the specific miscues identified for study here are a reflection of the graphic array (spelling) the readers confront. Comprehension related to the content established by the specific words (bows, tears, minute, does) is also significantly different: F (1, 45) equals 39.054 ($P < .01$) between the treatment samples, the i.t.a. sample demonstrating significantly superior results.

Since a frequency distribution of the miscue data suggested the existence of a poisson distribution, the data were transformed using arcsine transformation (Winer, 1971: 400) to insure that the assumptions of homogneity of the error variance related to continuous variables with a normal distribution were satisfied. Table III, showing the analysis of variance computed with the miscue data, indicates that the null hypothesis that

Table III

Analysis of Covariance: Miscue Data

Source	DF	YY	Sum-Squares (Due)	Sum-Squares (About)	DF	Mean-Square
Treatment (Between)	1	9.2436				
Error (Within)	48	2.9331	.1345	2.7986	45	.0622
Treatment plus error (Total)	49	12.1767	1.3183	10.8584	46	
Difference for testing adjusted treatment means				8.0598	1	8.0598

there would be no difference between treatments after adjusting with covariates is rejected since the F (1, 45) equaled 129.595. The results indicate that the transformation of the data did not reduce the high significance that could be attached to the mean differences in miscues produced by the samples. Orthographic change utilizing i.t.a. appeared to be a significantly potent factor in reducing or eliminating miscues. Differences between the samples on comprehension, when subjected to an analysis of covariance, remained similarly significant: F (1,45) equaled 39.025. $P < .01$.

In an attempt to develop further confidence in the results, an additional analysis was performed. A frequency distribution of the errors on each of the target words was computed. The miscue data shown below for both samples was

TABLE IV

Miscues on Target Words

Target Words	T.O. Sample	i.t.a. Sample	Pooled Error	Weight
bow	23	8	31	.43
tears	20	4	24	.34
read	25	0	25	.35
minute	25	20	45	.63
does	25	5	30	.42

pooled, the sum of squares of the pooled error on the target words was computed and used as the basis for normalizing the weight. A weighted score for each child in the sample was devised by summing the weights assigned to each word and these weights used as the values for a third analysis of covariance. The results in Table V reflect a more conservative view of the miscue errors produced by the samples. The null hypothesis that there would be no difference

TABLE V

Analysis of Covariance of the Miscues Data

Source	DF	YY	Sum-Squares (Due)	Sum-Squares (About)	DF	Mean-Square
Treatment (Between)	1	19.3441				
Error (Within)	48	5.7405	.0953	5.6450	45	.1254
Treatment plus error (Total)	49	25.0846	2.1942	22.8904	46	
Difference for testing adjusted treatment means				17.2453	1	17.2453

between treatments after adjusting with covariates was again rejected since the F (1, 45) equaled 137.473 ($P < .01$). Comprehension errors were similarly treated and the results subjected to analysis of covariance. The F (1, 45) equaled

31.952 ($P < .01$).

Conclusions

The F test results on comprehension in all three analyses were similar while the miscue analyses showed changes reflective of the more rigorous constraints placed on the data. In no case, however, was the result less than extremely significant. It can be concluded with a high degree of confidence that the use of a regularized orthography (i.t.a.) markedly reduced or eliminated miscue error. Thus regularized orthography is of significant value as a constraint on miscue error. Miscue errors as sampled by the target words are, in turn, largely an effect of orthography rather than as has been assumed primarily an effect of content and syntax. The above results, based on a limited sample of text, suggest that comprehension of meaning in a regularized orthography follows from word recognition and that words are of basic importance in reading. The results further suggest that the reader when confronted with misleading print (T.O.) must resort to other cues (semantics and syntax), utilizes regression in reading, and is less efficient in achieving comprehension.

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